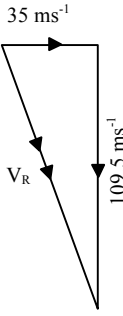
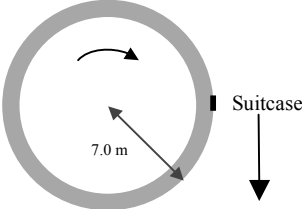


Assessment Schedule – 2007**Physics: Demonstrate understanding of mechanics (90255)****Evidence Statement**

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	<p>A projectile has only the force of gravity acting on. An aircraft is powered as it has its own motor and hence is acted on by more than one force. The path of a projectile is a parabola – that of an aircraft need not be so.</p>	<p>¹ Describe the motion of the aircraft or the projectile IN TERMS OF: force(s) (gravity, thrust, engine force, drag, air resistance, lift, etc) OR Parabolic path shape.</p>	<p>¹ Compares motion of aircraft to motion of projectile with reference to gravity and other force(s) AND Parabolic path.</p>	
(b)	<p>By Principal of Conservation of Energy $\text{Total } E_{KV} \text{ at bottom} = E_P \text{ at top} + E_K \text{ horizontal}$ $\frac{1}{2}mv_{\text{Total}}^2 = mgh + \frac{1}{2}mv_H^2$ $v_{\text{Total}} = \sqrt{(2gh + v_H^2)}$ $v_{\text{Total}} = 115 \text{ m s}^{-1}$ OR By Principal of Conservation of Energy VERTICALLY $E_{KV} \text{ at bottom} = E_P \text{ at top}$ $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 600} = 109.54 \text{ ms}^{-1}$ OR VERTICAL velocity when it reaches the ground $v_f^2 = v_i^2 + 2ad$ $v_f^2 = 0 + 2 \times 10 \times 600$ $v_f = 109.54 \text{ m s}^{-1} \text{ vert. down}$ OR VERTICAL velocity when it reaches the ground $d = v_i t + \frac{1}{2}at^2$ hence $t = \sqrt{2 \times 600 / 10} = 10.954 \text{ s}$ $v_f = v_i + at$ $v_f = 0 + 10 \times 10.95$ $v_f = 109.54 \text{ m s}^{-1} \text{ vert. down}$ THEN Horizontal velocity = 35 m s^{-1} Final velocity on reaching the ground $= \sqrt{109.5^2 + 35^2} = 114.99 \text{ m s}^{-1}$</p> 	<p>² Calculated vertical velocity correctly. OR Appropriate vector diagram, with arrows and labels.</p>	<p>² Calculated vertical velocity correctly. AND Appropriate vector diagram drawn with arrows and labels. OR Calculates the final speed.</p>	<p>² Calculated vertical velocity correctly. AND Appropriate vector diagram drawn with arrows and labels. AND Calculates the final speed.</p>
(c)		<p>¹ Vector diagram, with arrows and labels, but misunderstanding of air/ground speed on horizontal.</p>	<p>¹ Appropriate vector diagram drawn with arrows and all correct labels.</p>	

	<p>Also accept: Aircraft speed, Airspeed, Direction to point aircraft.</p> <p>Also accept: Wind, Wind speed.</p> <p>Also accept: Resultant, Ground speed, Direction of motion.</p> $\theta = \sin^{-1}\left(\frac{40}{100}\right) = 23.58^\circ \text{ Bearing} = 90 - 24 = 66^\circ$ <p>OR</p> $\phi = \cos^{-1}\left(\frac{40}{100}\right) = 66.42^\circ \text{ Bearing} = 66^\circ$	² Any identified angle calculated correctly.	² Achieved plus... Bearing correctly shown on diagram or clear from calculation. Doesn't need to be given to 3 figures.	
(d)	$a = (25 - 80) / 8 = -6.875$ $a = -6.9 \text{ m s}^{-2}$ OR $a = 6.9 \text{ m s}^{-2}$ in opposite direction to velocity.	² Calculates acceleration using (initial – final) OR Correct working BUT the stated direction is inconsistent with the sign.	² Correct working (using change = final – initial), and final answer is a valid physics statement with respect to sign and direction if stated.	
(d)	2 sf	¹ 2sf (any correctly rounded answer)		
TWO (a)	<p>Other suitable labels include: Weight, Force of gravity, support.</p>	¹ Arrows are of the correct size in relation to each other. OR Arrows are not to scale but have force values indicating their size.	¹ Arrows are of the correct size in relation to each other and appropriately labelled.	
(b)	$3 \times F_A = (0.80 \times 750) + (1.5 \times 220) + (2.25 \times 600)$ $3 \times F_A = 600 + 330 + 1350$ $F_A = 2280 \div 3$ $F_A = 760 \text{ N}$ OR $3 \times F_B = (0.75 \times 600) + (1.5 \times 220) + (2.20 \times 750)$ $3 \times F_B = 450 + 330 + 1650$ $F_B = 2430 \div 3$ $F_B = 810 \text{ N}$ $\Sigma F = 0$ therefore $F_A = 760 \text{ N}$	² States that clockwise and anticlockwise torques are equal. OR Calculate ANY correct torque.	² Correct formula and substitution but incorrectly determines ONE distance OR forgets to include the torque due to the beam. OR Calc $\Sigma \tau_{ac}$ about B OR Calc $\Sigma \tau_c$ about A	² Correct answer

THREE (a)		¹ Any arrow that shows a tangential direction . (Accept if arrow drawn tangentially at the end of the radius arrow).		
(b)	This is because the object is continually changing direction even though the speed remains the same. A change in direction amounts to a change in velocity as velocity is a vector. The rate of change of velocity is acceleration.	¹ States direction is continually changing. OR States that a centripetal force is acting on the suitcase.	¹ Links changing direction to the vector nature of velocity. OR Links changing direction to centripetal force.	¹ MERIT plus... Links changing velocity to acceleration. OR Links centripetal force to centripetal acceleration.
(c)	$F = \frac{mv^2}{r} \text{ hence } v = \sqrt{\frac{Fr}{m}}$ $v = \sqrt{\frac{5.5 \times 7.0}{18}} = 1.463$ $d = 2\pi r = 2\pi \times 7.0 = 43.982$ $T = \frac{d}{v}$ $T = \frac{43.982}{1.463} = 30.07 \text{ s}$	² Correct velocity. OR Correct circumference.	² Any two correct processes.	² Correct working and answer (Do not accept rounding for excellence if it causes a change in the significant figure answer).
(d)	$F = 25 \cos 40^\circ = 19.15 \text{ N}$ $W = Fd$ $W = 19.15 \times 0.80$ $W = 15.32 \text{ J}$	² Calculated work done without using the horizontal component of the force (20 Nm). OR Calculate horiz. force component only. OR Calculates work using an incorrect force component.	² Correct answer.	
(e)	<p>Momentum is conserved.</p> $(33 \times 3.6) + (35 \times 2.0) = (33 \times 2.4) + 35v$ $118.8 + 70 = 79.2 + 35v$ $v = 3.13 \text{ m s}^{-1}$ $E_k \text{ of trolley B} = \frac{1}{2}mv^2 = 0.5 \times 35 \times 3.13^2$ $E_k = 171.6 \text{ J}$	² States that momentum is conserved (maths or words). OR Determines Total p_{before} OR Total p_{after} OR Δp_A OR Δp_B	² Correct answer for velocity.	² Merit plus correct calculation of kinetic energy of trolley B. (Do not accept rounding for excellence if it causes a change in the significant figure answer).
(f)	Momentum is conserved assuming the absence of external forces such as friction or people pushing.	¹ Isolated system OR No external forces. OR No friction / push.	¹ Links an isolated system / absence of external forces to the friction / push. OR Identify both external forces.	

(g)	Elastic collisions <ul style="list-style-type: none"> Momentum is conserved, and Kinetic energy is conserved. Inelastic collisions <ul style="list-style-type: none"> Momentum is conserved, but Kinetic energy decreases as it is converted to heat/sound/elastic. 	¹ Momentum is conserved in all collisions. OR E_K is conserved in Elastic collisions. OR E_K is not conserved in inelastic collisions.	¹ Momentum is conserved in all collisions AND Both kinetic energy statements.	¹ Clear definitions of elastic and inelastic in terms of momentum and kinetic energy and identifies that E_K is transformed to heat/sound/elastic in inelastic. (DO NOT ACCEPT ALL kinetic energy for E).
FOUR (a)	$x = 72 - 51 = 21 \text{ cm} = 0.21 \text{ m}$ $F = 0.400 \times 10 = 4.0 \text{ N}$ $k = 4.0 \div 0.21 = 19 \text{ N m}^{-1}$	² Calculates k using either cm (0.19048) or g (19 048). OR Uses correct units but takes length as extension (5.56).	² Correct answer.	
	N m^{-1} (or kg s^{-2}) DO NOT ACCEPT lower case n for newtons .	¹ Correct unit.		
(b)	$m = 0.400 + 0.300 = 0.700$ $F = 0.700 \times 10 = 7.00 \text{ N}$ $k = 19.0 \text{ N m}^{-1}$ $x = F / k = 7.00 / 19.0 = 0.368 \text{ m}$ $E_p = \frac{1}{2} kx^2 = 0.5 \times 19.0 \times 0.368^2 = 1.29 \text{ J}$	² Calculates new extension.	² Correct working and answer.	
(c)	A spring with double the spring constant for the same weight force would mean half the extension as $F = kx$. As $E_p \propto k$, E_p doubles when k doubles for the same extension. As $E_p \propto x^2$ it decreases by four when x is halved for the same spring constant. Overall a spring with double the spring constant for the same weight force would mean half the extension and hence half the E_p .	¹ Has identified that extension and/or energy stored has decreased.	¹ Has qualitatively described and explained the effect of a higher spring constant on extension OR energy stored for the same weight force .	¹ Has quantitatively described AND explained the effect on BOTH the extension AND energy stored with a greater spring constant for the same weight force .

Judgement Statement

	Achievement	Achievement with Merit	Achievement with Excellence
Criterion One	$4 \times A1$	$3 \times A1 + 2 \times M1$	$3 \times A1 + 2 \times M1 + 1 \times E1$
Criterion Two	$4 \times A2$	$3 \times A2 + 3 \times M2$	$3 \times A2 + 3 \times M2 + 2 \times E2$

Marking Codes:

Working must be shown for Excellence and Merit answers.

- © Consequential marking – When a candidate is required to use the answer to a previous question that they answered incorrectly, the candidate will not be penalised again, provided the current solution is completely correct.
- ® Rounding error – Inappropriate rounding of an early step in a calculation results in a significant change in the final answer.
- Ⓙ Transcription error – Candidate demonstrates complete understanding of solution but incorrectly transcribes a value during one step of the processing.
- Ⓢ Solution error – Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to lack of understanding. Sufficient evidence implies that the last written step before the answer is given, has no unexpanded brackets or terms and does not require rearranging.